

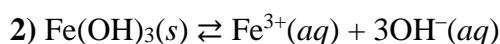
ANSWERS Solubility of solids in solutions with a common ion

$$\begin{aligned} 1) n(\text{Pb}(\text{NO}_3)_2) &= \frac{2.00 \text{ g}}{331 \text{ g mol}^{-1}} \\ &= 6.04 \times 10^{-3} \text{ mol} \end{aligned}$$

$$\begin{aligned} \therefore [\text{Pb}^{2+}] &= 6.04 \times 10^{-3} \text{ mol} / 0.500 \text{ L} \\ &= 1.21 \times 10^{-2} \text{ mol L}^{-1} \end{aligned}$$

$$\begin{aligned} Q &= (1.21 \times 10^{-2}) \times (0.440)^2 \\ &= 2.34 \times 10^{-3} \end{aligned}$$

As $Q > K_s$, **a precipitate will form.**



$$\text{Ion Product (IP)} = [\text{Fe}^{3+}] [\text{OH}^{-}]^3$$

$$\text{At pH 7, } [\text{OH}^{-}] = 1 \times 10^{-7} \text{ mol L}^{-1}$$

$$\text{IP} = [1.05 \times 10^{-4}] [1 \times 10^{-7}]^3 = 1.05 \times 10^{-25}$$

Since $\text{IP} > K_s$, $\text{Fe}(\text{OH})_3$ **will form a precipitate**



Less silver chromate dissolves.

Silver chromate is in equilibrium. More chromate ions shift this to the left.

$$4) n(\text{Pb}(\text{NO}_3)_2) = \frac{1.00 \text{ g}}{331 \text{ g mol}^{-1}} = 3.02 \times 10^{-3} \text{ mol}$$

If the lead nitrate is dissolved in the 500 mL, then $[\text{Pb}^{2+}] = 6.04 \times 10^{-3} \text{ mol L}^{-1}$

$$Q_s = [\text{Pb}^{2+}] [\text{Cl}^{-}]^2 = 6.04 \times 10^{-3} \times (0.440)^2 = 1.17 \times 10^{-3}$$

As $Q_s (1.17 \times 10^{-3})$ exceeds $K_s (1.60 \times 10^{-5})$, **a precipitate will form.**

5) The added Cl^{-} reduces the solubility of the NaCl . For the saturated solution:

$\text{NaCl}(\text{s}) \rightarrow \text{Na}^{+}(\text{aq}) + \text{Cl}^{-}(\text{aq})$. The addition of Cl^{-} causes the equilibrium to favour the reactants and hence a **precipitate will begin to form.**

$$6) \text{Ionic product} = [\text{Ca}^{2+}][\text{F}^{-}]^2$$

$$\text{and } [\text{F}^{-}] = 5 \times 10^{-5}$$

Ionic product

$$= (2 \times 10^{-4}) \rightleftharpoons (5 \times 10^{-5})^2$$

$$= 5 \times 10^{-13}$$

$$\text{IP} < K_s$$

So no precipitate will form.